

Introduction to 5 GHz wireless networking

5GHz Wireless Networking

Wireless networking using the unlicensed (and licensed) 5GHz frequency bands is the new kid on the block. It uses the same basic technology and methods as 802.11g (54Mbps) wireless but operating in the 5.1-5.8GHz frequency bands instead of the 2.4GHz band. Also, unlike 802.11g, it uses OFDM technology over the whole speed range (1-54Mbps); 11g only uses OFDM at speeds above 20Mbps.

Operating at the 5GHz radio bands has several advantages over the more common 2.4GHz band:

1. Better penetration
2. Better scatter
3. No abnormal adsorbtion by water or damp
4. Larger number of non-overlapping channels which means less radio congestion
5. OFDM over the whole speed range (better for non line of site operation)

On the downside, the Free Space Loss for 5GHz is about 6db worse than 2.4Ghz but, on the good side, the UK permitted power levels are 3-10db (depending upon the actual frequency) higher than 2.4GHz. This means, if you are using 5GHz for long range site-to-site connectivity you need to use a higher power level to cover the same distance.

However the raised permitted power levels and the better non-line-of-site capabilities makes it the preferred method for short range building-to-building connectivity and for in-building use.

There are three 5GHz frequency ranges permitted for wireless networking use in the UK:

Band A (5150-5350MHz), Licence free use

Band B (5470-5725MHz), Licence free use

Band C (5725-5850MHz), Licence required for operation

The bands in question for UK 802.11a equipment are 5150-5350 MHz (Band A), 5470-5725 MHz (Band B). The higher band, 5725-5850 MHz (Band C), is a licensed band to be used for the Installation of Fixed Wireless Access (FWA) services between stationary points. Bands A and B have been granted licence exempt status for use by public and private users with Band A for indoor mobile/nomadic and Band B for indoor and outdoor Wireless Local Area Networks (WLAN).

Please note that this differs from the 802.11a bands used in the USA. In the USA 11a equipment also uses the range 5.725GHz to 5.825GHz (Band C). However, the permitted power levels for use in the USA are much lower than the UK: The "low" band, 5.15 - 5.25 GHz, has a maximum of 50 mW (UK 200mW). The "middle" band is 5.25 - 5.35 GHz, with a maximum of 250 mW (UK 1W). The "high" band is 5.725 - 5.825 GHz, with a maximum of 1 W (UK 4W but licensed). For both these reasons (frequency range and power) it is NOT advisable to use 5GHz radio device imported from or destined for the US market.

The operational requirements for equipment operating in the 5GHz bands are stipulated in Interface Requirement IR 2006. It contains the following conditions:

Band A (5150-5350MHz)	Band B (5470-5725 MHz)
All devices must comply with ERC Decision 99(23) and IR 2006 (including Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS)).	All devices must comply with ERC Decision 99(23) and IR 2006 (including Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS)).
All devices must be part of a mobile/nomadic network	
Max EIRP 200mW	Max EIRP 1W
Indoor use only.	Indoor and outdoor use permitted.
Band C (5725-5850MHz)	
All devices must comply with IR 2007.	
Max EIRP 4W with a PSD not exceeding 23dBm/MHz	
Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS) are mandatory	
Fixed Service Operations only	

The IEEE 802.11a standard defines physical-layer rates of 1, 2, 5.5, 11, 6, 9, 12, 18, 24, 36, 48 and 54 Mbps. Some products also support a so called Turbo or Super speed which uses two channels simultaneously to give improved speed. The actual maximum user throughput is given in the table below:

Standard	Wireless Speed	Actual TCP Speed	Actual UDP Speed
802.11a	54 Mbps	24.4 Mbps	30.5 Mbps
802.11aTURBO	108 Mbps	42.9 Mbps	54.8 Mbps

For long range and building-to-building operations where you don't have a clear line-of-site 5GHz seems to be ideal! Higher permitted power levels and OFDM technology mean, with the correct antenna used, distances of at least 10Km are possible even when LOS isn't necessarily there. See our article [Wireless Technical Discussion](#) for more information on linking building using wireless.

Better penetration and the ability to scatter around walls and inside buildings also give significant improvements when trying to reach those hard to get to places in houses or business premises.

The only downside really for 5GHz radio devices is cost. However, as popularity increases expect to see much more competitive pricing in the future. When it comes to either outdoor bridging use or indoor client use 5GHz seems to be the answer.

Further details on the 5GHz frequency bands including a technical discussion on their use

and application can be found in our separate article [5GHz Frequency Bands](#)

See our [Wireless Networking Prima](#) for a broad overview.

A useful article to read if you are looking to link buildings is [Linking Buildings using Wireless](#)